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THE QUALITY OF PHILIPPINE COCONUT STATISTICS

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I. INTRODUCTION

According to official statistics from the Bureau of Agricultural Economics (BAECON), Philippine production of coconuts in 1980 was 15.6 million metric tons (mt).[1] This was 52 percent higher than the 10.2 million mt estimate from the 1980 Census of Agriculture, a difference which cannot possibly be explained away by sampling errors and deviations in concepts and definitions. There was closer agreement on the estimates of hectarage under coconut (3.1 million by BAECON and 3.0 million by the Census) and of the population of bearing trees (328.0 million and 320.9 million, respectively). However, these implied estimates of yield were at variance: viz. 5.0 mt/ha by BAECON and 3.4 mt/ha from the Census. Based on BAECON data, each bearing tree produced an average of 48 nuts during the year, while the corresponding estimate from the Census was only 32; the difference of 16 nuts is roughly equivalent to two bunches or three months of harvest.

Based on BAECON data, the Philippines could claim that it produced 38 percent of the total world output of coconuts; the Census estimate indicated only a 29 percent share (see, e.g., APCC 1986).

The Philippine Coconut Authority (PCA) also collects data on the coconut industry. Its estimates of coconut area show close concordance with those of other sources; e.g., PCA estimates of 3.1 million hectares in 1982 increased marginally to 3.2 million in 1986, compared with the 3.2 million and 3.3 million BAECON estimates for the same years, respectively. On the other hand, the PCA estimated that coconut production increased from 8.8 million mt in 1982 to 12.2 million mt in 1986, while BAECON estimates showed

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1. BAECON was renamed Bureau of Agricultural Statistics (BAS) in 1987. Coconut production was collected originally as number of nuts, and later expressed in weight units assuming 1 nut to be equivalent to 1 kilogram.

a decrease from 14.0 million mt to 11.9 million mt during the same period (source of data: Mangabat and Tepora 1990). The yields obtained from these statistics are in conflict: based on PCA data, coconut yield climbed from 2.9 mt/ha in 1982 to 3.8 mt/ha in 1986, but according to BAECON, the yield declined from 4.4 mt/ha to 3.6 mt/ha during the same period.

Such was – and still is – the state of coconut statistics in the Philippines.

II. ABOUT THE PAPER

The major provider of Philippine crops statistics had been BAECON (now renamed BAS). These statistics may be divided into two groups depending on the sampling and data collection methods used to produce them. One group consists of those generated from the Rice and Corn Surveys, which use probability sampling and household interviews for collecting the basic data. The statistics on all *Other Crops,* i.e., excluding rice and corn, comprise the second group which – as will be described in more detail later – are based on nonprobability sampling and on a variety of basic data sources such as traders and large producers, as well as on subjective or "informed" guesses by BAECON/BAS field staff. Such major differences in the methods used are likely to impart great divergence in the quality (e.g., accuracy) of the resulting statistics, so much so that a relatively broad assessment of the country's agricultural crops data base will require separate evaluations of the two groups of statistics.

A recent study found out that the Philippines' official series on corn area and production are seriously biased upwards (David et al. 1990). The same goes for the growth rates derived from the series. Although one of the objectives of the Rice and Corn Surveys (and of most surveys undertaken by the Philippine Statistical System) is to produce accurate and reliable provincial level data, the study showed that even regional level estimates failed to achieve this objective, as these suffered from serious overestimation and very high year-to-year fluctuation. This cast doubt on the usefulness of regional and, more certainly, provincial estimates. The study assumed that aggregate statistics on rice may already be of acceptable quality; however, in view of the findings on corn, an evaluation of the former may be a worthwhile research exercise also.

The present study picks coconut – the most important among the *Other Crops* group – as the subject of an evaluation study along the lines of the earlier paper on corn. The results should provide insights on the quality of the statistics in this second group which, in combination with the results on corn, might give a wider assessment of the quality of the country's statistics on agricultural crops (with the probable exception of rice). The paper documents the procedures used in producing statistics for crops other than rice and corn, which have never been published. The next section describes the sample selection, data collection and estimation for the *Other Crops* group, as prescribed in BAECON/BAS manuals and as actually carried out by field personnel. Section IV presents and analyzes results of this survey strategy in the case of coconut statistics. Sections V and VI give detailed comparisons of the BAECON/BAS coconut statistics with those from the 1980 Census of Agriculture and PCA, respectively. Section VII is a summary of the study's main findings and section VIII contains recommendations. Finally, the BAECON/BAS primary data used in the study are given in the Appendix tables.

III. SURVEY SAMPLING STRATEGY FOR THE OTHER CROPS GROUP

A. *As Prescribed in BAECON/BAS Instructions to Field Staff*

Before the recent paper by Mangabat and Tepora (1990), very little had been published or circulated regarding the sampling strategy and data collection methods used for the *Other Crops* group. In addition to their paper, the main source for the presentation here is a BAECON/BAS computer printout entitled, "Guide for Estimation of Area and Production of Crops Other Than Rice and Corn." The draft given to the authors in late 1988 (called Guide from hereon in) was undated, but it is their understanding tha it has more or less been followed since the late 1970s and, with some modifications such as on the frequency of reporting, is still in use.

The Guide's introductory statements extol the use of "pooled experts' opinion" as an inexpensive method of generating statistical information. Recognizing that the method is incapable of providing measures of accuracy or precision of the resulting estimates, the Guide defends the nonprobability or subjective method by stating that, if systematically done, there is no reason why it should not lead to reliable data. The question, of course, is what is meant by a systematic (but) subjective method? The Guide's implicit answer is found in the subsequent procedures it prescribes.

First Procedure: Informal Stratification/Multi-Stage Approach to Data Collection

The top BAECON/BAS personnel in the province is the Provincial Agricultural Statistics Officer (PASO). He is in charge of BAS operations, particularly data collection, and he has under his supervision a number of field enumerators. With the launching of the RADDS-MAIMI3 project in 1980, agricultural technicians of the then Ministry (now Department) of Agriculture were made to cooperate with the PASO in data gathering. A province was divided into districts consisting of a few towns. The agricultural technicians were designated as either municipal program statisticians (MPS) or district program leaders (DPL). An MPS was assigned to a town (not necessarily a different person in each town), and he and the DPL constituted the "nucleus of experts" responsible for the subjective estimation of any crop data for the different municipalities in the district. Likewise, the DPLs and the PASO comprised the "nucleus of experts" responsible for provincial estimates. After the RADDS-MAIMIS[2] project got scrapped in 1985, *the PASO became the sole person accountable even for municipal level estimates.*

The Guide states that towns (reporting units) are divided further into barangays (subreporting units), but there is inadequate instruction on how to deal with the latter, whether these are sampled or covered completely, and who are assigned to them.

This ambivalence or vagueness runs through the entire Guide, thus giving the PASO and his staff more than the desired latitude in carrying out the survey and producing the estimates.

Second Procedure: Determination of Respondents

To identify the respondents, the Guide suggests first that the nuclei of experts determine who are the growers of each crop; tries to group these in some fashion, e.g., occasional versus regular growers, organized versus unorganized planters; and then suggests further that "if such categories exists, it might be of help if you make estimates by category." The Guide continues: "Identify who are the best possible sources of information for each category of

2. The Regional Agricultural Data Delivery System — Ministry of Agriculture Integrated Management Information System Project was a joint undertaking between BAECON and the Ministry of Agriculture, which had as an objective the production and dissemination of agricultural statistics at the town level. Juxtaposing this objective with the quality of provincial and regional statistics (see section II, second paragraph), it is not surprising at all that the project was a complete failure.

growers. You do not need to list them all in names; simply identify a few from each of the traders for that crop, the agriculturists in the area, operators of large plantation and whoever you think are knowledgeable of the data needed." Note that this vests the PASO with blanket authority to choose his respondents whose number is indeterminate (how few is few?) and whose names need not even be listed. The instruction assumes also that the PASO knows the best possible sources and he could identify those knowledgeable of the data needed. Significantly, the Guide does not specify small and medium farm operators among the preferred sources of information.

Large plantations in a town are to be treated separately (but the Guide does not say how large is large): "When there are less than 20, the PASO is told to 'conduct a complete enumeration of these plantations at the end of the reference period or during the time you are making a report.' For 20 plantations or more, *perhaps* you need to undertake sampling to estimate area and production" (underscoring supplied). Does he, or doesn't he, sample; and if so, how, and how many? The natural temptation would be a simple size very close to zero.

Third Procedure: Data Collection and Estimation

The Guide suggests the use of what it calls *indicators* for area and production of each crop. For area, the suggested indicators are average size of farms, number of growers and percentage change from a base period. How these data are to be obtained is not clear. In fact, getting average farm area can be just as difficult and troublesome as estimating the main target – total area – directly. For production, yield per unit area is suggested as the best indicator, again without describing how the latter is to be arrived at and also overlooking the possibility that yield and production are equally difficult to measure. At any rate, two methods of estimation are proposed, the so-called direct approach, viz., total area = number of farms X average area per farm, and total production = total area X yield per unit area; and the so-called indirect approach, e.g., total area = total area at some base period X rate of change from base period up to reference period.

The above methods are for crops planted in solid patches only, according to the Guide. For crops planted in unorganized patterns, like fruit trees in backyards, the suggestion to fieldmen is to "estimate first the number of trees and then divide this by the planting density." Presumably, fieldmen are provided with "standard" planting density tables for different crops, probably the same as those prevailing in solid patches; otherwise this is like trying to solve one equation with two unknowns.

The forms to be used in recording the data collected need not be uniform. The Guide says that "field personnel may develop their own forms depending on their convenience." This is perhaps due to the observation that data come from different sources and formats between towns and provinces.

In trying to justify these methods of data collection and estimation the Guide makes statements which could leave many pondering BAECON/BAS' stand on modern survey sampling methods, the impact of these statements on the fieldmen's attitude towards statistical data collection in particular and survey operations in general, and the effect of all these on the official statistics being released to the public. As an example: "Subjective estimation is not (a) guess work. It has to have a systematic acquisition of data to be able to generate credible results. The acquisition of data is very different from that of normal survey where there are specific rules to be followed starting in the selection of samples up to the processing of the data gathered. Here the method is more of an art governed by general rules but *with an end result equally acceptable and useful as those gathered from the conventional probability surveys."* (Underscoring ours.)

Fourth Procedure: Some Form of Data Screening/Validation

The DPLs and MPSs are supposed to deliberate on the town level estimates, try to explain marked changes from the estimates of the previous period, and revise unusually large increases or decreases that they cannot adequately explain. This process leads to mutually agreed district estimates. The PASO and the DPLs repeat the process on the district estimates to arrive at provincial estimates to be sent to the BAS central office in the form of semiannual reports. The Guide says that such report should always be accompanied by a brief analysis with emphasis on the changes in area and production relative to the previous period. All these functions were vested in the PASO after the termination of the RADDS-MAIMIS project.

B. *As Carried Out in Practice: Results of Interview with PASOs*

With so much open-endedness in the instructions and flexibility given to fieldmen on how to do a survey, it would not be surprising if the operations employed to carry out the *Other Crops* survey varied significantly across provinces. There could even be departures from the Guide. To verify this,one of the authors interviewed nineteen PASOs from major coconut producing provinces to find out how they actually arrived at their respective estimates.

Sample selection is indeed done in a highly subjective manner. Each PASO seemingly has his own way of choosing who he should interview and how many. There are those who ask known coconut farmers from supposedly sample barangays for each of the municipalities under their domain. The other respondents are barangay captains, Coconut Development Officers (CDOs) of the Philippine Coconut Authority, coconut/copra traders, and sometimes the PASO himself if he happens to be a coconut grower. The biggest sample size given is five coconut farmers for each of the five sample barangays within each municipality. The extreme case is a sample size of one where the estimate for the province is based on the PASO's own observation from his coconut farm and on ocular trips across the place. Further, no more estimates at the municipal level are being generated ever since the RADDS-MAIMIS project got scrapped, i.e., the information gathered is somehow used to directly produce provincial estimates of area, production and tree population.

Informal interview is the method employed by all the PASOs. There is no formal questionnaire. Instead of estimating actual figures in every round, most PASOs find it more convenient to simply ask respondents how their coconut crop for the current quarter compares with that of the previous quarter and with that of the same quarter of the past year. Some estimate of change is arrived at based on the two responses, which is applied to a base data. As such, the reliability of the base data is crucial. It seems, however, that many PASOs take this fact for granted as attested by the scant information they have on how the benchmark data being used was obtained in the first place. This is as if base data were being presumed synonymous with data existing before the PASO assumed office. Among the 19 PASOs interviewed, only one had a precise idea of where the benchmark data being used for his province came from, which was from another agency which did a special study on coconut in a few selected provinces sometime in the late 1960s or early 1970s.

Typically, questions are asked on production and/or yield only. Annual changes in the estimates of area and number of trees and bearing trees are calculated based on certain information gathered informally by the PASO, e.g., coconut areas converted to other crops, shift in land use from agricultural to commercial/residential, coconut replanting programs or typhoon damage as gathered from either the respondents or some other sources.

Since the CDOs of the PCA gather data for only one crop, the PASOs generally view the estimates of this other group as "more reliable" than theirs although they are unaware of how these are arrived at (see section VI). As a form of validation, the CDOs are commonly consulted first before the PASOs send their final figures to the BAS central office. On the other hand, there are also cases wherein the PASO regards his estimates as "better," thinking that PCA data tend to be biased towards making an improved assessment instead of trying to objectively depict the actual situation.

IV. PROPERTIES OF BAECON/BAS COCONUT DATA

A. *Preliminaries*

The presentation here will be limited to estimates of area, production, number of trees and ratios such as yields. For brevity, only the latest nine-year data (1978-1986) are used which, as the ensuing discussion will show, are sufficient to reveal the essential characteristics of the BAECON/BAS data.[3] First, however, some caveats may be in order, including some remarks on concepts and definitions used in producing coconut statistics.

1. *Collection and Reporting of Coconut Data*

BAECON/BAS collects production in *number of matured nuts without husk.* Estimates are reported in different units of forms according to end-use by following prespecified conversion factors, viz.,

Reporting unit/form	*Conversion factor*
nut	1 nut = 1 kg
copra	1 kg copra = 4.5 nuts
desiccated coconut	1 kg d.c. = 5.0 nuts
homemade oil	1 kg oil = 7.5 nuts
foodnut	1 kg = 0.8 nut

Obviously, the accuracy of estimates for provinces, regions and the country depends on the accuracy of these conversion ratios. In the case of area, the reporting for irregular or scattered planting is also based on conversion ratios (i.e., using planting densities in compact

3. Although data for 1987 and 1988 were already available during the conduct of the study, these were not included in the analysis as the method used for collecting them was changed again. While the change may be moderate, it may have sufficiently affected the series such that, for practical purposes, a break in the series may be considered between 1986 and 1987.

farms). However, the choice of planting density to use is left entirely to the field personnel, most often the PASO.

2. *Changes in Sources and Methods*

Even with a short nine-year series, there is no assurance that the same sources and methods were followed each year. Switches in field personnel assignments could introduce changes in the series because the final selection of respondents and estimation are left to their discretion. The sources can change too. For instance, while the usual sources of coconut statistics are the Semi-Annual Reports (SAR), which are the end-products of the survey sampling strategy for *Other Crops* described in section III, there were years when the SAR-based estimates were replaced by estimates from other sources. This was particularly true prior to 1988 when rider questionnaires on other crops were included in the Rice and Corn Surveys. Although coconut statistics from the rider questionnaire were intended primarily to check on the SAR-based estimates, there were some years when the former looked "more reasonable" to BAECON central office personnel and were adopted as the official estimates.

As mentioned previously, the methodology for the *Other Crops* surveys was started – or, more precisely, formalized – in connection with the RADDS-MAIMIS project which was to produce town level statistics. With over 4,000 towns nationwide, the eventual demise of this overly ambitious project was never in doubt, as indeed it was suspended in 1985. In fact, the methodology (section III) was never fully implemented. However, the problem is that there is no record of which components were implemented and which were not, in the same manner that users outside BAECON/BAS have no way of knowing which years in the BAECON/BAS coconut series were from SAR or from RCS. Moreover, another change was instituted beginning in the third quarter of 1988, when the format and frequency of reporting production were changed from a semestral to a quarterly basis.

3. *Publication Policy*

BAECON/BAS releases to the public official statistics at the regional and national levels only. Provincial estimates generally are not released because of quality problems, i.e., perceived or observed lack of accuracy. Obviously, this practice is grounded on the notion that, although provincial estimates are inaccurate, the simple process of adding them up results in regional and national estimates that are reasonably more accurate. This is, at best, a half-truth.

In probability sampling, sampling error certainly goes down with increasing sample size, but ever so slowly, for their relationship is of the order $n^{-1/2}$, not 1/n as some practitioners are inclined to believe. However, given the highly subjective and oft-times ad hoc nature of the data collection and estimation procedures being used, nonsampling errors will be the dominant error or source of inaccuracy in the coconut (and the rest of the *Other Crops*) statistics. And nonsampling errors are not necessarily affected inversely by increasing sample size: some, like those systematically introduced via faulty measuring devices and methods tend to be constant, while those influenced by field conditions such as the quality of supervision may actually increase with larger samples. Thus, substantial improvements in the accuracy of regional and national estimates could occur only if systematic biases are small to begin with and in the event that the other nonsampling errors at the provincial levels go in opposite directions such that they tend to wash out during the addition process. However, it can also be argued *a priori* that the opposite is just as equally, if not more likely, to happen, i.e., the nonsampling errors in the provincial estimates tend to have the same sign, in which case the inaccuracy of the higher level estimates will actually increase in absolute terms or will persist in the same magnitude in relative terms.

In summary, statistical science guarantees that, with probability sampling, bigger samples lead to lower sampling error, but not nonsampling error, hence not total error; or, what amounts to the same thing, precision, but not necessarily accuracy, increases with sample size. For empirical illustrations, see subsection V.B.

What usually happens when provincial estimates are added is that quantum jumps and dips in the series are flattened somewhat and irregular plots are moderated into smoother curves; these, however, could lull users into a heightened but not totally warranted confidence in the data.

4. *"Validated" and "Unvalidated" Data*

Recently, BAS produced what it calls validated coconut data series for 1978-1988. These data were the results of efforts to cross-check and examine the consistency of BAECON/BAS data with those from other sources, particularly the PCA. As near as we can tell, these were intended to replace the official series released earlier, which were subsequently labelled unvalidated data. The so-called "validation" procedure involved principally sending the earlier released provincial series to the respective PASOs for examination

– eyeballing mainly – and for the PASOs to make the revisions they deemed desirable or necessary. Further revisions were made at the BAS central office for some years where there were supplementary sources of information, e.g., 1979 and 1983 input-output tables. The revisions were substantial even at the national level, as seen from Table 1 below. It is also strange that, compared to the original or unvalidated estimates, the validated data were lower during the first half, then higher by almost the same (absolute) magnitude during the second half of the series. (The same pattern is observed with the series on area.) This could be because of the sudden drop in the unvalidated series from around 14-16 million tons during 1978-1982 to 11-12 million tons during 1983-1987 – and it is but natural, with the benefit of a 10-year hindsight, for fieldmen to try to "correct the oversight" and come out with a smoother series. This raises a number of questions: Can fieldmen change data of up to 10 years ago and be expected to come up with more accurate substitutes? Or is this like pulling a fast one on users who will have to choose between the two series? Given the significant changes, e.g., from a series showing markedly declining production to another presenting stable estimates, what is to be done to studies and plans based on the original series? Should official statistics that used the original series as input, e.g., national and regional accounts, be revised?

Table 1
"UNVALIDATED" AND "VALIDATED" BAS ESTIMATES, PHILIPPINES
(Coconut production, in '000 metric tons)

Year	Unvalidated	Validated	% Difference
1978	14,882	14,205	– 4
1979	15,799	12,634	–20
1980	15,592	13,369	–14
1981	14,860	14,190	– 4
1982	14,005	13,146	– 6
1983	10,894	12,368	14
1984	10,973	11,738	7
1985	11,154	12,828	15
1986	11,926	14,335	20
1987	11,803	13,730	16
1988	10,800	12,842	16

Source: Mangabat and Tepora, *ibid.*

Differences are more pronounced at the provincial and regional levels. Figure 1 shows a comparison between the unvalidated and validated estimates of production, area and yield for the four provinces of Central Visayas.[4] Note that the unvalidated series show declining production, while the validated series tend to depict stable output. The area estimates have constrasting patterns: By some unknown or undocumented reasoning process, the BAS field staff reduced the unvalidated estimates by almost half their values to arrive at the validated estimates in Bohol and Siquijor; on the other hand, the former were almost doubled to arrive at the latter in Negros Oriental; and in Cebu the revised estimates were almost constant for 11 years, while the unvalidated estimates ranged from 40 to 52 thousand hectares. The yields also paint two very different pictures, with the unvalidated estimates showing continuously declining yields,[5] while the validated data show relatively uniform yields during the period. Which is which?

The fact that BAS field staff can change drastically the trend and magnitude of their previous estimates, sometimes by as much as 100 percent, invites speculation. It may be indicative of BAS' low confidence in its own data, for instance. One can also conjecture a self-assessment on the part of the BAS that the estimates are subject to nonsampling errors in the order of 100 percent.

B. *Choice of Data*

In view of the foregoing discussion, the rest of the paper will be based exclusively on the original or unvalidated provincial data. These are given in the Appendix tables for area, production, and number of bearing trees for 1978-1986. Another reason for this choice is that one of the study's aims is to assess the direct output of the present statistical data production system for the *Other Crops* group. The so-called validated estimates are products of a retrospective process that is not likely to be repeated. (We also advise against it.)

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4. The choice of Region 7 is simply for brevity's sake, it being the smallest region, with four provinces. Note that the unvalidated series stop after 1986 because that was about the time when the series (from 1978) were sent to the field staff to review, revise and extend -- the results of which were the validated series. Validated national (and perhaps also regional) estimates were produced subsequently at the BAS central office even for the years 1987 and 1988, as shown in Table 4.1.

5. This trend is observable also among the majority of the provinces; correctly or not, this may have contributed to the off-quoted statement -- and now taken for granted fact -- that the country's coconut tree population was ageing, which was why yields were declining. This, in turn, led to a multi-billion peso coconut replanting program.

Figure 1. Comparison of Unvalidated (U) and Validated (V)
BAS Data, Region 7 Provinces

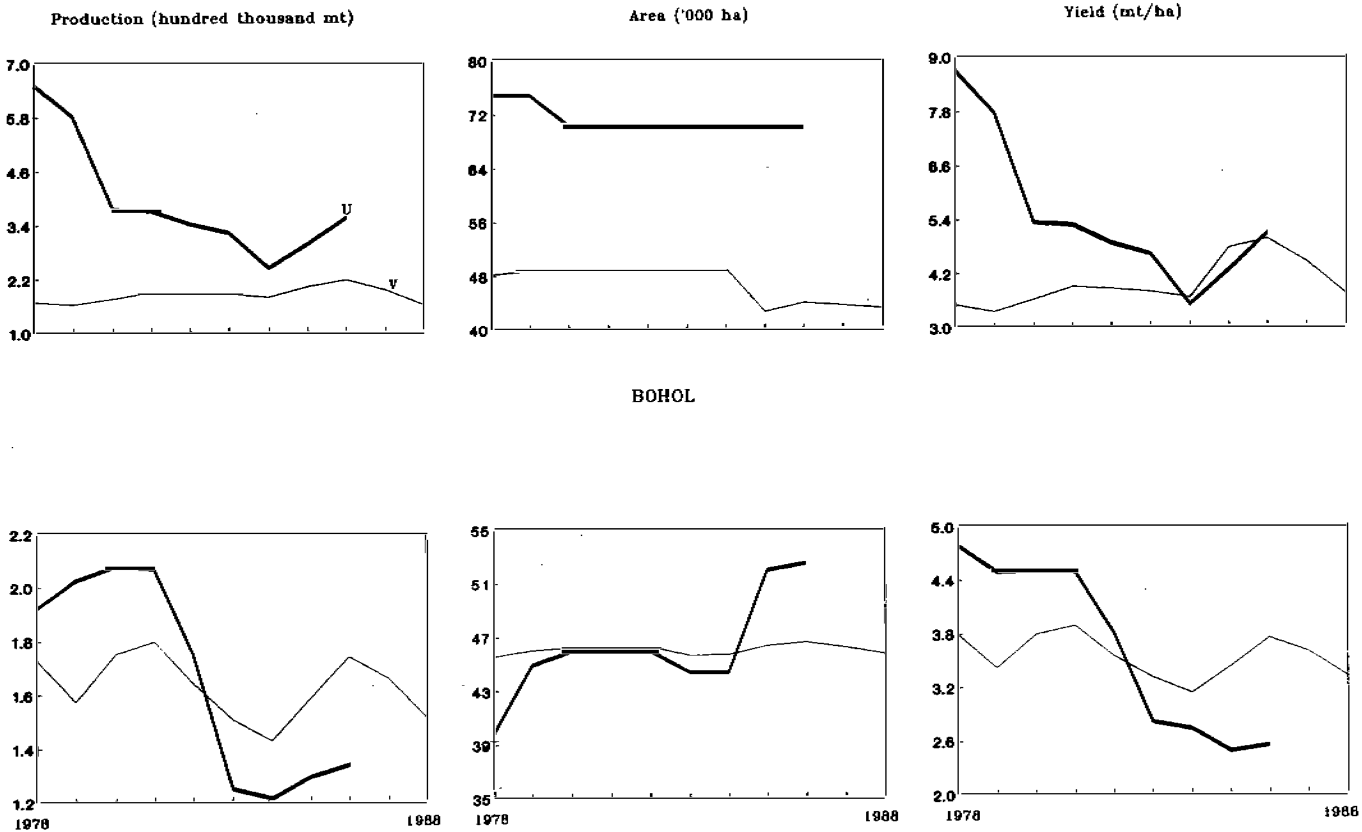
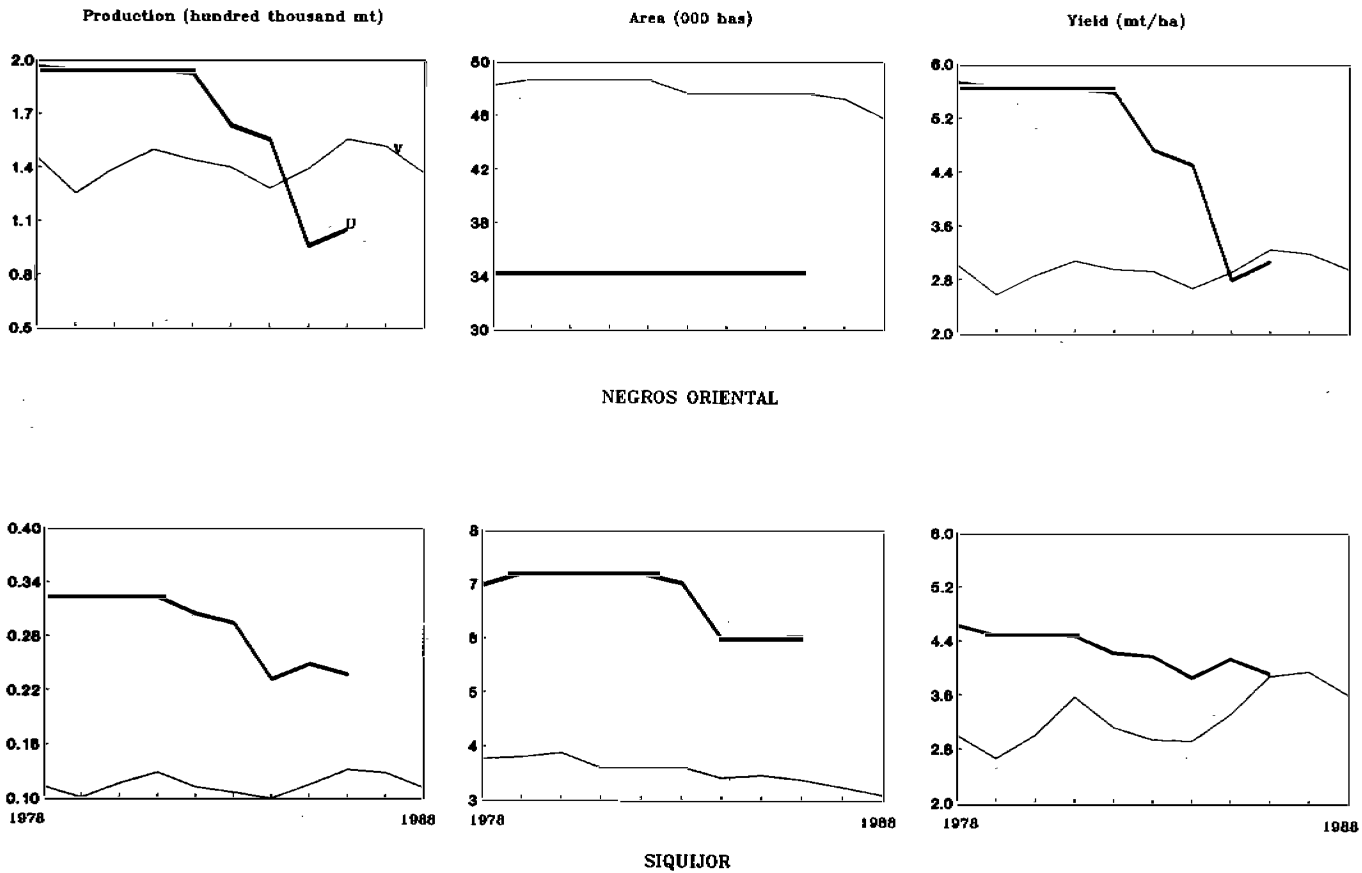


Figure 1. Cont'd.



C. *Provincial Estimates*

Again, for economy of presentation, we pick only the provinces in one region, namely, Southern Luzon. Depending on which data source to quote, the share of the region in total coconut production in 1980 was either 34 percent (BAECON/BAS) or 17 percent (Census). (The corresponding figures for area were 18 percent and 21 percent.) Plots of estimates of total area, production and number of bearing trees in the 11 provinces of the region are shown in Figure 2.

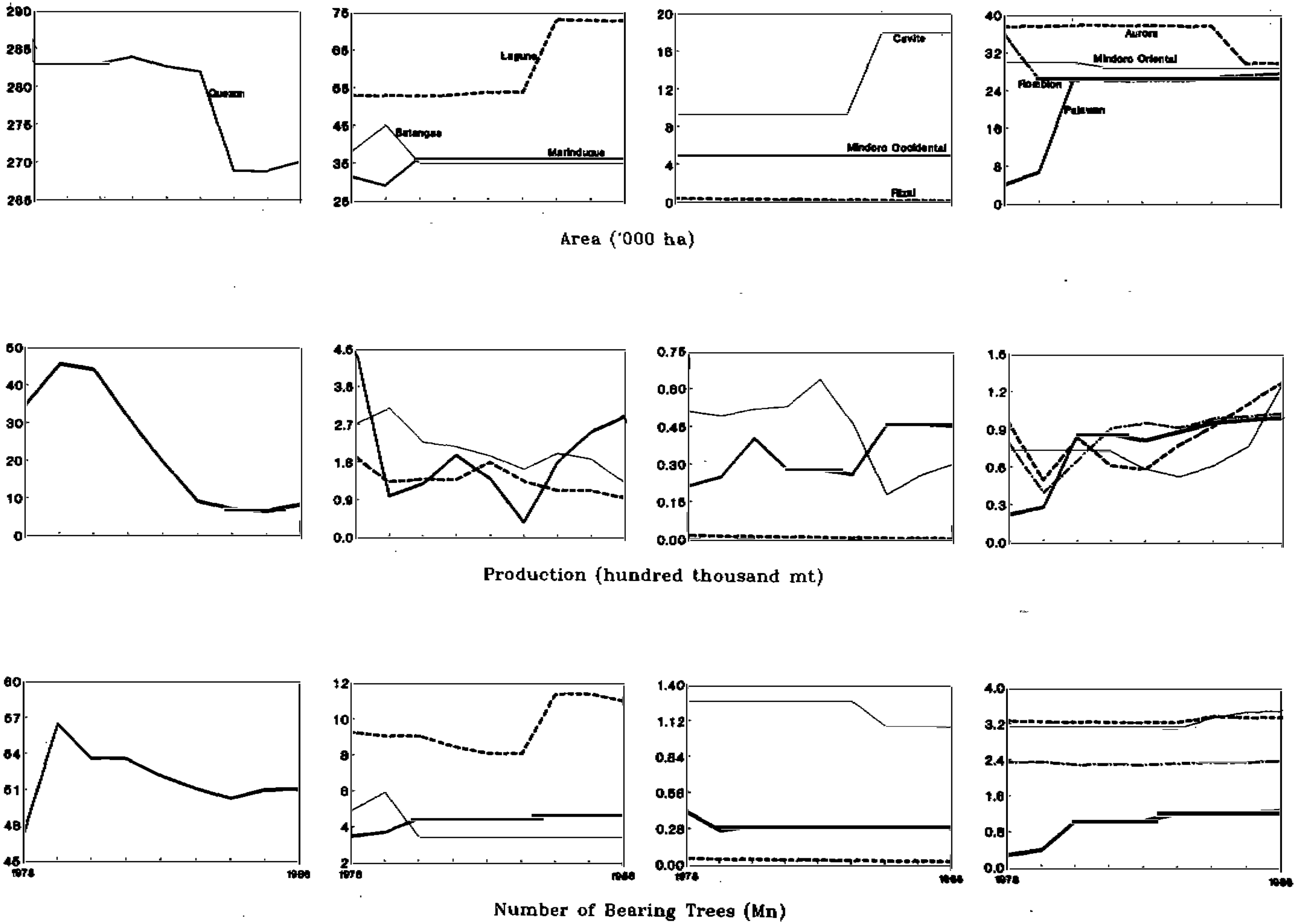
1. *Area*

It is the abrupt changes from one year to the next that are most striking about these data series, making many of the graphs look like step functions, which are contrary to the common expectation of either stable or slowly rising or declining trends. Some of these abrupt changes defy logic; e.g., the area planted to coconut in Cavite almost doubled in one year, from 9,383 hectares in 1983 to 18,096 hectares in 1984. According to the statistics, 19,120 hectares were newly planted to coconut in Laguna between 1983 and 1984, thus raising total coconut area from 54,050 hectares to 73,170 hectares; and in Palawan, the coconut area increased almost fourfold from 6,832 hectares in 1979 to 26,843 hectares in 1980. On the other hand, almost 10,000 hectares planted to coconut in Romblon disappeared between 1978 and 1979, as did 8,000 in Aurora from 1984 to 1985, and 13,000 in Quezon from 1983 to 1984.

One would like to hope that these abrupt changes are based on factual field observations, for the massive planting of new areas and large-scale cutting of trees implied by these estimates cannot possibly escape public (including BAECON personnel) attention. Likewise, estimates being reported may give users the impression that they are accurate up to the last hectare even when the magnitude runs up to thousands; e.g., consider the estimates in Quezon for the period 1980-1984, in hectares: 283073, 284073, 282724, 282124, 268945. (See Appendix 1.)

On the other hand, some of the reported changes can evoke skepticism, if not incredulity. For example, at a density of 150 plants per hectare, close to three million seedlings would have been required to establish 19,000 hectares of new coconut groves in Laguna alone in one year. Only a huge government-assisted project cold stand a chance of producing such resource in a short span of

Figure 2. Area, Production and Number of Bearing Trees, Region 4 Provinces.



time.[6] Moreover, 19,000 hectares represent more than 50 percent of the total farm area planted to crops other than coconut in Laguna (based on the 1980 Census of Agriculture). Such massive shift to coconut, if it did occur, would reflect significantly on the statistics for the replaced crops, something which, we are most certain, was not observed.

These observations bring to the fore the probability of very high nonsampling errors in the estimates of coconut area. Since the other coconut statistics are generated in the same way, these too would be subject to large nonsampling errors.

2. *Production*

The BAECON estimates in some provinces suggest that production was measured accurately up to the last nut. For example, the original reported productions in Quezon for 1984-1986 were 749804060, 700633009 and 879406208 nuts or kilograms. (We expressed these in thousand metric tons in Appendix 2.) These look ludicrous when set against the very subjective manner in which the basic data were obtained.

Allowing for higher yearly fluctuations in production than in area due to vagaries of weather, especially typhoons and droughts, one should expect similar medium to longer-term trends among provinces in the same region. The statistics show otherwise: It is seen from Figure 2 that production in Batangas, Cavite, Laguna and Quezon has been declining noticeably. In Quezon, the estimated production in 1986 (879 thousand mt) was only 20 percent of the estimate in 1980 (4,451 thousand mt). On the other hand, the estimated production in Marinduque, Mindoro provinces, Palawan, Romblon and Aurora has been climbing markedly. In Aurora, which is adjacent to Quezon, production is estimated to have increased by 50 percent, and in Mindoro Oriental by 75 percent during the same period.

There are also changes in the production data that defy easy explanations; e.g. the 80 and 50 percent drops in Marinduque and Aurora between 1978 and 1979, respectively, the 75 percent increase in Mindoro Occidental between 1983 and 1984, and the 200 percent increase in Palawan from 1979 to 1980.

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6. The BAECON/BAS reports of planting density in the Southern Tagalog region in 1980 ranged from 100 to 200 trees per hectare. One of the authors recalls the periodic beautification programs under the previous administration, wherein a project to plant coconut along a southern stretch of the Pan Philippine Highway taxed the supply of coconut seedlings from nurseries in the area.

3. *Number of Bearing Trees*

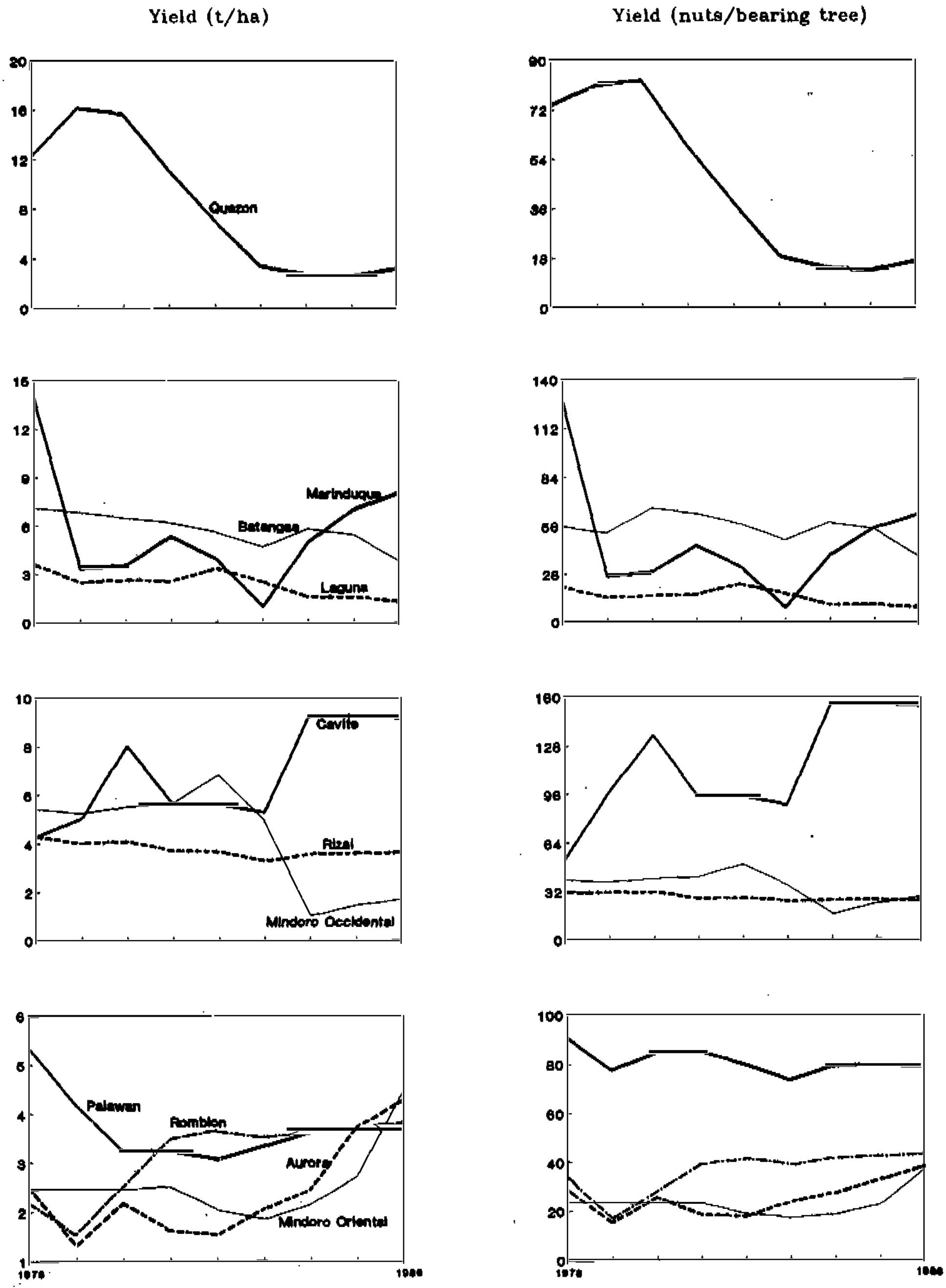
These estimates lend further support to the interpretation that the abrupt changes in the coconut statistics are by and large due more to nonsampling errors than fact. This is the most probable explanation for the "disappearance" of 2.5 million bearing trees in Batangas between 1979 and 1980, which translates to 17 thousand hectares of mature trees (see Appendix 3). Likewise, the estimates show 3.3 million more bearing trees in Laguna from 1983 to 1984; 9.4 million more in Quezon from 1978 to 1979; and in the latter province a net decrease of 5.4 million bearing trees was reported between 1979 and 1986.

4. *Estimates of Yield*

With a perennial crop like coconut where the yearly harvest comes from the same trees, one should expect the yield to be quite stable, allowing only for short-term (1-3 year cycle) fluctuations due to weather effects and gradual long-term growth or decline due to technological change. The short-term fluctuations could have pronounced dips followed by gradual climbs, which is in keeping with the drastic effects of typhoons and droughts and the longer time required for the crops to recover. The advancing age of Philippine coconut trees has often been mentioned as one cause of the (supposedly) declining yields, as well as justification for an erstwhile massive replanting program. One does not hear of any serious claim to significant technological innovations in the Philippine coconut industry; hence, one would not expect to find a sustained positive growth in the yield curves.

The plots of the yields (metric tons/ha and nuts/bearing tree) are shown in Figure 3. Many of these do not follow biological and scientific expectation described in the preceding paragraph. There is something clearly and seriously wrong with some of them. Consider Quezon, the biggest coconut growing province in the country; First, it is biologically implausible, and certainly more so under Philippine field conditions, for the yield to reach 16 mt/ha , as reported in 1979 and 1980. On average, this figure implies that a bunch with 13 nuts is harvested every 45 days on every coconut tree in the province, assuming a planting density of 150 trees per hectare, all of which should be productive. Second, the yield continuously fell from 16 mt/ha in 1980 to less than 3 mt/ha in 1984; since the area estimates did not change significantly during the same period, the data by themselves would indicate that some other factors of production underwent changes of near catastrophic proportions to have caused

Figure 3. Estimates of Yield in Region 4 Provinces.



this decline in productivity. If this were so, the yields in the neighboring provinces should exhibit similar patterns — which is not the case. The conclusion will have to be that the production and yield series are erroneous. It is somewhat disconcerting that errors of this magnitude slip through the *Other Crops* survey system's data screening procedures.

Similar though less glaring cases can be found in Figure 3, e.g., Marinduque, Cavite. On the whole, the yield estimates suffer from inconsistency both within and between provinces in the sense that: (i) the individual yield curves exhibit very high year-to-year variability as described above; and (ii) some provinces portray declining yields while others show increasing yields during the same period.

D. *Regional Estimates*

Two outliers stand out among the graphs of the yields in Regions 4-12 (see Figure 4). First there are the very high values in Region 4 (Southern Luzon) during 1978-82. These are due to the unreasonably high production (and yield) estimates in Quezon as pointed out in the previous subsection. The coconut industry in the province is of sufficiently large magnitude that it dominates the yield curve of the whole region. Second, the yields in Region 11 (Southern Mindanao) are much higher than those of the others regions from 1982 to 1986. In 1986, for example, the 7.1 mt/ha estimate for the region was 87 percent higher than the second highest figure which is for Region 7, Central Visayas, with 3.7 mt/ha , and 255 percent higher than the 2.0 mt/ha estimate for Region 5 (Bicol). It would be worth finding out if this extraordinary high yield estimate is a close reflection of the truth, if only to attempt to replicate in the other regions some of the technology (outside of weather factors) used to achieve it. A check with the data of the provinces showed that the high yields in Region 11 are traceable to Davao Oriental and Davao del Norte, which recorded yields of around 10 mt/ha. The estimated total coconut area in these two provinces was 254 thousand hectares, which was 46 percent of the total for the region.

E. *Country Estimates*

It can be seen from the foregoing subsection and Figure 4 that some — at least two — regional data have serious errors in them. Moreover, these large errors can be traced to a few provinces. An insight on the probable error of country level estimates could be

Figure 4. Yields in the Coconut Growing Regions.

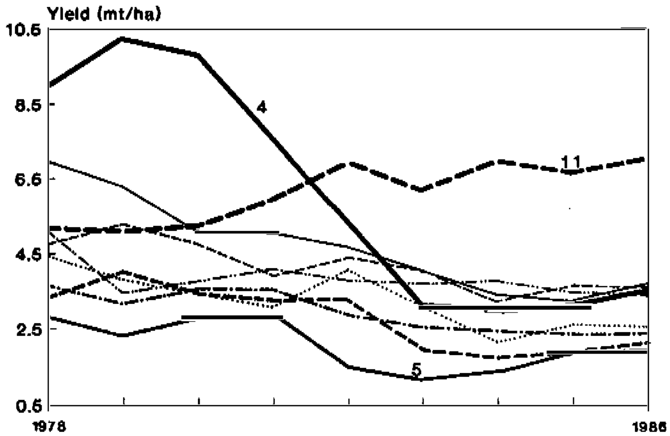
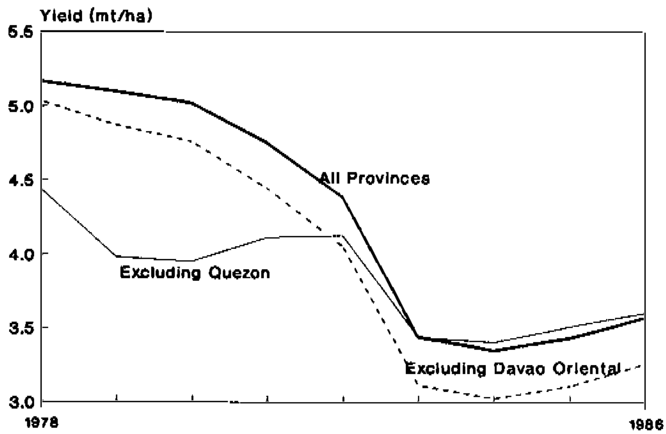


Figure 5. Coconut Yields, Philippines.



gained if one considered the effects of these few manifestly erroneous provincial data on the former. For instance, the coconut yields for the Philippines are plotted in Figure 5, alongside the yields with Quezon excluded from the computations. Notice that in some years, the two graphs are separated by as much as 1.0 mt/ ha., which could be indicative of an error of as much as 20 percent (relative to a 5.0 mt/ha. estimate) for the whole country from 1978 to 1980. Similarly, the gap between the whole country and the "excluding Davao Oriental" estimates toward the later years was as high as 0.4 mt/ha., which was over 10 percent of the whole country estimate. These indicative error levels are much higher than the acceptable 2-3 percent error rate for country estimates.

V. COMPARISON OF BAECON/BAS AND 1980 CENSUS DATA

A. *The 1980 Census of Agriculture*

The data collection and estimation in the 1980 census are very different from those employed in the *Other Crops* surveys of BAECON/BAS. As far as coconut data are concerned, all large farms (with four or more hectares) were covered completely in the census; 10 percent of small farms were drawn using simple systematic sampling with a single independent start in each town. The total number of sample farms (large and small) was almost 800,000 nationwide. The town totals were estimated independently by adding the small sample farms total multiplied by the reciprocal of the sampling fraction and the large farms total. Provincial and higher level totals were built from the town estimates.

Unlike in the *Other Crops* surveys of BAECON/BAS, the basic data in the census were obtained from face-to-face interviews with respondent farm households. Production, which was dichotomized into mature and green nuts (buko), pertained to the harvest from all productive trees. There was no attempt to impute the area covered by the irregularly planted trees, so that the census estimate of coconut area pertained to compact plantations only. Moreover, the census estimate of the population of trees includes all trees in compact farms plus productive trees that are irregularly planted, i.e., excluding young or nonproductive trees outside compact farms. BAECON/BAS estimates of area are inclusive of the area covered by irregularly planted trees, and the total number of trees and bearing trees are estimated separately. The reference period for the census was the 1980 calendar year, with the basic data collected in May 1981. On the other hand, BAECON/BAS data collection was semestral (July and January) with the reference period being the immediate past six months, and the two estimates are added to arrive at calendar year estimates.

B. *Area, Production and Number of Bearing Trees*

To save space and still be able to do broader comparisons, estimates for the country, for Regions 4-12 only, and for provinces in the Southern Tagalog region only are shown in Table 2. (Based on the census figures, less than 0.5 percent of the total coconut area is found in the first three regions.)

The difference between the BAECON and census estimates of total area is a comfortable 3.6 percent, which has the right sign since the census estimate is expected to be smaller, it being exclusive of the area covered by irregularly planted trees. However, the discrepancies between the estimates of regional totals can be described as neither acceptable nor tolerable. Some have the unexpected (minus) sign, like the two major coconut growing regions in Luzon, namely, Southern Tagalog where the census estimate is 89,000 hectares higher (−14 percent) and Bicol where the difference is 168,000 hectares (−32 percent). The discrepancies are very high in Regions 10, 11 and 12 where 111,000 ha. (43 percent), 131,000 ha (30 percent) and 94,000 ha (56 percent), respectively, separate the BAECON and census figures. The smallest differences are in the neighborhood of ± 14 percent.

The differences at the provincial levels are very large also. The census estimate in Quezon is higher than the BAECON estimate by more than 100,000 ha. In relative terms, the discrepancies range from −66 percent to 257 percent.

At the national level, the BAECON estimate of total production in 1980 was 52 percent higher than the census estimate. At the regional levels, the relative differences ranged from −36 percent to 207 percent. The latter is in Southern Tagalog, where the BAECON estimate of 5.4 million mt is 3.6 million mt higher than the census estimate of 1.7 million mt. Most of this difference can be traced to Quezon, where the BAS estimate is 360 percent higher than the census estimate, which in absolute terms equates to a 3.5 million mt difference. In one case – Mindoro Occidental – the BAECON estimate is over 12 times larger than the census estimate. It can be verified that more than 10 major coconut growing provinces had BAECON estimates that were more than double their corresponding census estimates.

Thus, even if no strong assumptions concerning the accuracy of the census data are made, and considering the findings in the previous section, it is tempting to conjecture that the BAECON estimates of production tend to be seriously positively biased. This is the case not only with the provincial estimates, but also with the regional and countrywide estimates. Furthermore, readers willing to take the view that the census estimates are relatively accurate to the point that they can be usefully regarded as baseline information against which others may be compared will be led by the Table 2 comparisons to the following conclusions: (a) BAECON estimates of production, at least, are seriously inaccurate even at the national level, for an error of 52 percent is large by most standards or purposes for which statistics are used; and (b) it cannot be assumed in practice that regional estimates are more accurate than provincial estimates, nor does it follow that national estimates are more accurate than regional data from which they are built. In relative terms, this is apparent from the relative differences columns of Table 5.1. It is also true in absolute terms; e.g., the 5.3 million mt difference between the national estimates of production is higher than the 3.6 million mt difference between the Southern Luzon estimates, which in turn is bigger than the 3.5 million mt difference between the estimates of production in Quezon. Several other examples can be found in Table 2.

In general, it appears that there is closer agreement between the two sources' estimates of the number of bearing trees than either production or area. This piece of observation may have potential future use in trying to improve the measurement or estimation of the last two characteristics. The observed relative difference between the country estimates is a very tolerable 2.2 percent. However, at the regional levels, the relative differences still range from −48 percent to 61 percent. The relative differences in the provincial estimates in the Southern Luzon provinces range from −67 percent to 227 percent.

C. *Yields*

The BAECON estimate of yield (mt/ha or nuts/ha) for the country was 47 percent higher than the census figure. For the regions, the relative differences between the two sets of estimates ranged from a low −2 percent to a very high 257 percent. The latter was in Southern Luzon, which unfortunately is the most important coconut growing region, where the BAECON and census estimates were 9,900 and 2,800 nuts per hectare, respectively. Most of this discrepancy can be traced to the estimates in Quezon (which unfortunately also is the most important coconut growing province)

Table 2. Comparison of 1980 BAECON and Census Estimates of Coconut Area, Production, Number of Bearing Trees, and Yields.

Region/Province	Area ('000 ha) BAECON	Area Census a/	Area Diff. b/ (%)	Production ('000 mt) BAECON c/	Production Census	Production Diff. (%)	Bearing trees ('000) BAECON	Bearing trees Census	Bearing trees Diff. (%)	Yield (mt/ha) BAECON	Yield (mt/ha) Census d/	Yield (mt/ha) Diff. (%)	Yield (nuts/bearing tree) BAECON	Yield (nuts/bearing tree) Census	Yield (nuts/bearing tree) Diff. (%)
Batangas	35.0	21.6	61.9	227.8	115.9	96.4	3,432	3,607	–4.9	6.5	5.4	21.3	66	32	106.5
Cavite	9.4	7.0	34.6	51.9	38.3	35.7	1,275	1,145	11.4	5.5	5.5	0.8	41	33	21.8
Laguna	53.0	38.7	37.1	140.3	206.3	–32.0	9,078	6,487	39.9	2.6	5.3	–50.4	15	32	–51.4
Marinduque	36.6	28.9	26.8	131.1	88.1	48.8	4,410	3,604	22.4	3.6	3.1	17.4	30	24	21.6
Mindoro Occidental	5.1	2.0	153.8	40.7	3.0	1274.5	300	194	54.4	8.1	1.5	441.6	136	15	790.4
Mindoro Oriental	30.0	49.0	–38.8	73.8	136.2	–45.8	3,149	4,382	–28.1	2.5	2.8	–11.4	23	31	–24.6
Palawan	26.8	41.1	–34.7	87.2	103.7	–15.9	1,027	3,116	–67.0	3.2	2.5	28.7	85	33	155.2
Quezon	283.1	387.8	–27.0	4,451.6	967.2	360.3	53,670	44,494	20.6	15.7	2.5	530.5	83	22	281.6
Rizal	0.3	0.9	–65.9	1.3	1.1	22.9	41	102	–59.9	4.1	1.1	260.6	32	10	206.2
Romblon	26.1	45.2	–42.3	65.7	68.9	–4.6	2,314	4,034	–42.6	2.5	1.5	65.3	28	17	66.3
Aurora	38.1	10.7	256.6	83.2	16.8	395.4	3,249	995	226.7	2.2	1.6	38.9	26	17	51.7
(4) Southern Luzon	543.4	632.7	–14.1	5,354.5	1,745.4	206.8	81,945	72,160	13.6	9.9	2.8	257.2	65	24	170.2
(5) Bicol	351.0	519.4	–32.4	978.5	1,527.8	–36.0	28,107	53,739	–47.7	2.8	2.9	–5.2	35	28	22.5
(6) Western Visayas	94.4	81.4	15.9	464.0	255.2	81.8	11,914	10,047	18.6	4.9	3.1	56.8	39	25	53.3
(7) Central Visayas	158.2	139.0	13.8	813.2	474.6	71.3	22,090	18,276	20.9	5.1	3.4	50.5	37	26	41.8
(8) Eastern Visayas	333.5	406.7	–18.0	1,199.9	1,348.5	–11.0	40,038	44,574	–10.2	3.6	3.3	8.5	30	30	–0.9
(9) Western Mindanao	411.0	352.2	16.7	1,429.3	1,318.3	8.4	32,040	34,683	–7.6	3.5	3.7	–7.1	45	38	17.4
(10) Northern Mindanao	368.1	257.5	42.9	1,249.4	970.6	28.7	36,127	25,582	41.2	3.4	3.8	–9.9	35	38	–8.8
(11) Southern Mindanao	561.4	430.3	30.5	2,958.6	1,910.3	54.9	48,532	44,835	8.2	5.3	4.4	18.7	61	43	43.1
(12) Central Mindanao	260.4	166.4	56.4	1,016.8	662.9	53.4	24,495	15,186	61.3	3.9	4.0	–1.9	42	44	–4.9
Philippines	3,103.1	2,995.8	3.6	15,592.6	10,248.4	52.1	327,973	320,871	2.2	5.0	3.4	46.9	48	32	48.9

a/ For compact plantations only.

b/ Diff = 100 x (BAECON – Census)/Census.

c/ BAECON estimates production in number of nuts, which is converted to kilograms using a nut–to–kilogram ratio of 1:1.

d/ Numerator includes production from irregularly planted trees, but numerator is area of compact plantations only.

Source of Census Data: National Census and Statistics Office, 1980 Census of Agriculture Final Report, Volume II.

where the relative difference between the two estimates was 530 percent.

Another measure of yield is annual production of nuts/bearing tree. Sixteen nuts separate the two estimates for the country, which translates into a 49 percent relative difference. Predictably, some but not all of the differences at the regional and provincial levels are higher. Thus, like production and yield per hectare, it appears that BAECON estimates of yield in nuts/bearing tree are seriously biased upwards; and this is the case not only with provincial but with regional and whole country estimates as well. Moreover, although the bias is positive in general and in the majority of cases, there are also large negative biases; together these imply that the estimates can be subject to very large root mean square errors, to an extent that puts the usefulness of the estimates in serious question.

D. *Additional Observations*

The direction of the difference (relative to the census values) can differ among variables even if the comparison is confined within a province or region. For example, in Quezon the BAECON estimate of area was less than the census estimate (−27 percent), but the BAECON estimate of production was much more than that of the census (+360 percent). Conversely, in Laguna the BAECON estimate of area was higher than the census estimate (+37 percent), but the opposite was observed with the production estimates (−32 percent). When all the relative differences between area and production estimates are computed and put on a scatter diagram, the relationship that emerges is shown in Figure 6. The points on quadrants I and III are those provinces where the relative differences are of the same sign (+ and − respectively). There are many more points on quadrant I, some of which are very far from the origin, i.e., BAECON estimates of areas and production tend to be positively and seriously biased. However, the relationship cannot be generalized and simplified, since there are provinces where the biases are negative, and worse, they can go in opposite directions, as with provinces with points falling on quadrants II and IV.

Because of the complex relationship between the probable biases in the production and area estimates of the provinces (which can extend over to the regions, e.g., see Southern Luzon in Table 2), the behavior of the relationship between these and their ratios (viz., yields) can be more unpredictable and complicated. Thus, the plot of the relative differences in area against the relative differences in yield (mt/ha.) shows more reversals in signs; i.e., compare Figures 6 and 7.

Figure 6. Scatter Plot of % Differences Between BAECON and Census Provincial Estimates: Area X Production.

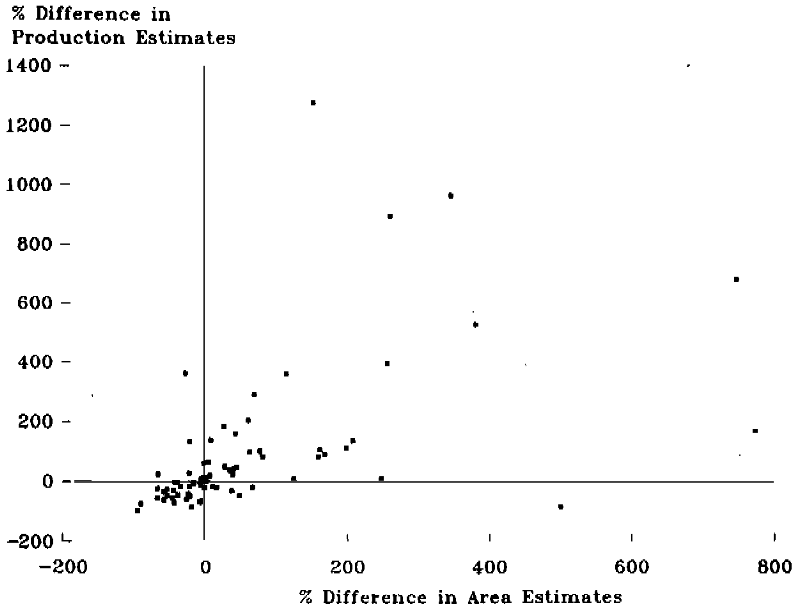
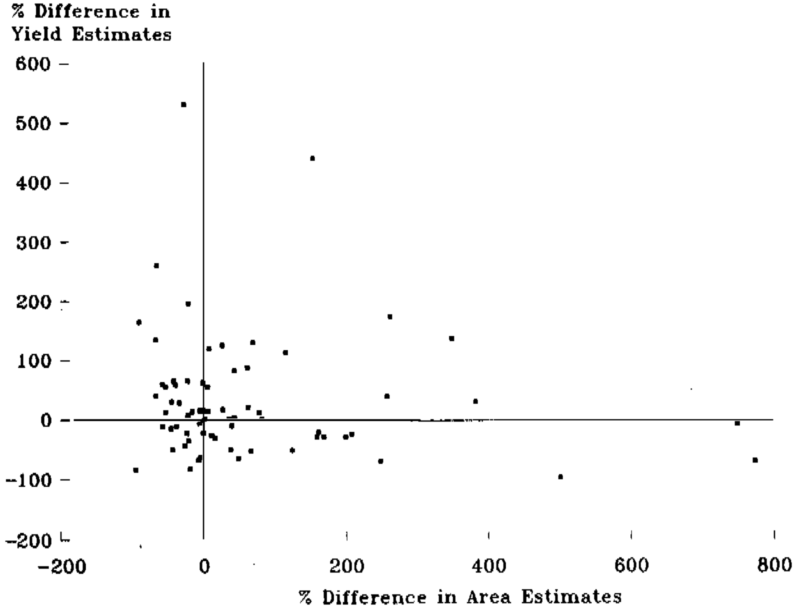


Figure 7. Scatter Plot of % Differences Between BAECON and Census Provincial Estimates: Area X Yield (mt/ha).



In summary, while the errors in the BAECON coconut statistics tend to be positive, there are provinces in the regions where these can go in the opposite direction. Moreover, the errors of the estimates for the major characteristics do not always follow the same distribution or pattern. Perhaps this unpredictability of the direction and pattern of errors is related to the unusually wide scope given to provincial staff in choosing their own subjective methods of sample selection, data collection and estimation.

VI. COMPARISON OF BAECON/BAS AND PCA DATA

A. *Data Collection Methods at the Philippine Coconut Authority (PCA)*

The PCA is another agency which collects data on and monitors the coconut industry. The agency groups the 61 major coconut producing provinces into eight regions which are different from the present 13 political regions commonly used by everybody else. Basic data collection rests on Coconut Development Officers (CDOs) who also serve as extension workers. Each CDO is assigned 3-5 towns and reports to regional project coordinators. Statistics on area, production and tree population were collected in 1982, 1984 and 1986; there was, however, no documentation, nor were definite procedures followed. Summary forms were simply sent from the PCA central office to the CDOs who were required to fill in the required data (Mangabat and Tepora, op. cit.).

The PCA also monitors copra production on a monthly basis through field reports of copra sales from registered processors. These data may and are often converted to production of nuts using the ratio 4.5 nuts per kilogram of copra. One obvious source of underestimation here is nonresponse or nonregistration of some copra processors.

For purposes of forecasting copra production, a nationwide sample of trees was obtained as follows: First, two-way stratification was used to construct four strata out of the coconut area in a province, namely, coastal-flat, coastal-upland, inland-flat and inland-upland areas. Coastal areas cover those within two miles from the shore.

Second, two sample farms were to be selected from each stratum. The instruction sheet has this to say about how to select these farms: "Sample farms must represent the most common farming system (example: if most of the farm(s) are unfertilized, get your sample from these farms) and planted with coconut population/cultivar common in the province (example: Laguna population in Region VIII). The age of the trees must represent the average of the province." What is described here is purposive sampling, not probability sampling. What is said is how the farms should look like, instead of the precise procedure for selecting the farms. The instruction also assumes that the CDOs know the average age of trees in the province, the proportion of farms being fertilized, etc.

Third, "thirty (30) sample trees will be randomly selected and marked with the corresponding number within the selected farm." This statement is insufficient to guarantee that a random, i.e., equal probability, sample will indeed be selected.

The instruction sheet goes on: count the number of nuts on the six oldest bunches of all sample trees; multiply the observed number by 2 to estimate the total harvested for the year; divide by the number of sample trees to estimate the average per tree; multiply by the number of bearing trees in the province; and finally, divide by the conversion factor (to copra).

The same deficiencies are found here as in the BAECON/BAS procedure in the planning and execution of statistical data collection operations: the use of nonprobability sampling; inadequate instructions, thus leaving too much to the discretion of the field personnel; procedures dependent on the assumption that field personnel know so many things, such as the average age of trees in the province, what is flat land as opposed to upland, inland as opposed to coastal land, the proportion of unfertilized farms, etc.; and dependence of the final estimates on extraneous estimates that may be erroneous and just as problematic to obtain and update, such as number of bearing trees in the province.

B. *Quality of PCA Data*

As mentioned above, the PCA collected data on area, production and tree population in 1982, 1984 and 1986. Consider the PCA estimates for the country:

	1982	1984	1986
Area (million hectares)	3.1	4.3	3.2
Production (million mt)	8.8	11.9	12.2
Bearing trees (million)	19.9	n.a.	365
Yield (mt/ha)	2.9	2.8	3.8
Yield (nuts/bearing tree)	44	n.a.	33

Even first-time users of these data (like the authors) would be hard pressed to ignore the following: (i) In two short years (1982-84), the

Philippines gained 1.2 million more hectares of coconut; however, an almost equal area (1.1 million) disappeared during the next two years. As they say in that wonderful world of magic, "Now you see it, now you don't." (ii) The estimated population of bearing trees increased from 199 million in 1982 to 365 million in 1986. At 150 trees per hectare, 166 million more trees translate to 1.1 million hectares; compare this with the estimated net gain in area of 0.1 million hectares! Moreover, these were bearing trees, which means they must be at least 8-10 years old (if indeed they existed). (iii) The production estimates showed an increase of just under 40 percent, from 8.8 million mt in 1982 to 12.2 million mt in 1986. These lead to thoroughly discordant yield values, depending on whether to use area or number of bearing trees as divisor: *According to PCA data, coconut farms had somehow grown robust, increasing their yields from 2.9 mt/ha in 1982 to 3.8 mt/ha in 1986, although the trees on them had turned sickly and reduced their production of nuts from 44 to 33 per tree during the same period.*

An obvious conclusion here is that the PCA data suffer from serious internal inconsistencies, which are indicative of gross errors. One wonders why these major flaws have not been pointed out earlier, and wonders even more why these data were put out in the first place.

C. *Numerical Comparisons*

The BAECON and PCA estimates of area, production and number of bearing trees for 1982, 1984 and 1986 are shown in Table 6.1 for the Philippines and Regions 4-12. In general, the differences between the two sets have narrowed in 1986 compared to the earlier years. Large differences remain at the regional level estimates, however, and these range from −47 percent to 130 percent.

One important trait of the modern scientific method — in which statistical tools play central roles — that distinguishes it from the archaic methods that it supplanted is replicability (of results). With continuing surveys using sound statistical methods, replicability means some guarantee that the errors in the estimates will be within measurable bounds, thus providing more stable time series; hence, the probability is high that real signals would rise above the noise. A high price paid for using subjective, nonstatistical methods is the forfeiture of the replicability property of results, as seen in the wild swings of either BAECON or PCA estimates. Consider, for instance, the abrupt changes in the PCA estimates of area, production and number of bearing rees, as discussed in the previous

Table 3. Comparison of BAECON and PCA Data on Area, Production and Number of Bearing Trees.

Region	1982 BAECON	1982 PCA	1982 % Diff	1984 BAECON	1984 PCA	1984 % Diff	1986 BAECON	1986 PCA	1986 % Diff
AREA ('000 has)									
4 Southern Tagalog	543	424	–22	558	1,292	132	552	449	–19
5 Bicol	335	474	41	364	520	43	429	514	20
6 Western Visayas	118	112	–5	106	140	32	106	140	32
7 Central Visayas	158	178	13	155	193	25	163	194	19
8 Eastern Visayas	338	387	14	356	539	51	335	389	16
9 Western Mindanao	452	377	–17	483	462	–4	477	470	–1
10 Northern Mindanao	369	305	–17	363	392	8	365	406	11
11 Southern Mindanao	546	547	0	555	530	–5	554	427	–23
12 Central Mindanao	309	251	–19	309	206	–33	329	225	–32
Philippines	3,191	3,074	–4	3,272	4,293	31	3,335	3,236	–3
PRODUCTION ('000 mt)									
4 Southern Tagalog	2,918	1,334	–54	1,672	2,889	73	1,949	1,955	0
5 Bicol	507	1,119	121	511	1,408	176	836	1,925	130
6 Western Visayas	522	261	–50	367	601	64	389	205	–47
7 Central Visayas	745	551	–26	548	279	–49	621	562	–10
8 Eastern Visayas	1,013	554	–45	900	1,598	78	871	1,210	39
9 Western Mindanao	1,872	1,123	–40	1,111	1,221	10	1,298	1,340	3
10 Northern Mindanao	1,272	660	–48	660	1,367	107	772	1,172	52
11 Southern Mindanao	3,796	2,338	–38	3,878	1,675	–57	3,919	2,287	–42
12 Central Mindanao	1,215	786	–35	1,181	835	–29	1,136	1,447	27
Philippines	14,005	8,784	–37	10,973	11,941	9	11,926	12,163	2

Table 3 (continued)

Region	1982 BAECON	1982 PCA	1982 % Diff	1984 BAECON	1984 PCA	1984 % Diff	1986 BAECON	1986 PCA	1986 % Diff
NUMBER OF BEARING TREES ('000)									
4 Southern Tagalog	79,529	38,581	–51				82,515	73,010	–12
5 Bicol	23,775	40,957	72		No PCA data.		29,575	54,923	86
6 Western Visayas	14,445	6,866	–52				11,329	13,551	20
7 Central Visayas	21,293	10,891	–49				19,429	17,786	–8
8 Eastern Visayas	43,174	23,450	–46				38,160	43,487	14
9 Western Mindanao	46,168	24,520	–47				42,594	43,376	2
10 Northern Mindanao	37,359	26,457	–29				35,473	35,687	1
11 Southern Mindanao	48,773	14,914	–69				54,243	58,696	8
12 Central Mindanao	25,305	10,111	–60				26,220	22,526	–14
Philippines	342,723	198,937	–42				342,413	364,886	7

Source: Mangabat and Tepora, op. cit.

subsection. Such gyrations in the time series estimates take so much of the (potential) credibility of the data. The same can be said of the BAECON data, as discussed in sections IV and V.

A question begging to be asked is: Why does the country have two very subjective sets of coconut data, both obtained using public funds?

VII. SUMMARY OF MAIN FINDINGS

The data collection and estimation for crops other than rice and corn is being done by BAECON/BAS on a very subjective basis. The provincial agricultural statistics officers (PASOs) are essentially left to themselves to report the required estimates to the central office. The sample size used in a province range from one to an indeterminate number, chosen judgmentally by the PASO. The more common method of arriving at estimates is to try to assess from the sample, the growth rate of the variable in question and then, apply this to a base period estimate. In the case of coconut, the latter had been chosen years ago by previous PASOs. Despite these shortcomings, the estimates of total area and production are reported up to the last hectare or nut. However, viewed as time series, these exhibit changes that defy logic, such as sudden jumps or drops in area and biologically implausible yields. There are indications of very high nonsampling errors.

The magnitude of the differences between BAECON and 1980 agricultural census estimates casts serious doubt on the quality and usefulness of the former. At the provincial level the relative differences exceeded 1,000 percent in one case. The tendency was for BAECON estimates to be on the high side, although this was not always the case. Since nonsampling errors do not necessarily cancel out during addition, serious errors at the regional level estimates were likely also, as indicated by the relative differences in ranges — minus 32 percent to 56 percent for area and minus 36 percent to 206 percent for production. Thus the release to the public of regional level estimates with the implied assurance that these are adequately accurate needs to be carefully reconsidered. At the national level, a seemingly respectable 3.6 percent difference separated the estimates of area; however, the relative differences between production and yield estimates were around 50 percent.

Over at the PCA, summary statistics forms were simply sent from the central office to the field to be filled in by coconut development officers without the benefit of written instructions or guidelines. Predictably, the results of this carefree approach to statistical data collection teetered toward the preposterous: from zero correlation between what should be almost perfectly linearly dependent series to thoroughly contradictory yield estimates of the same coconut fields.

VIII. FURTHER OBSERVATIONS AND RECOMMENDATIONS

As mentioned in section II, it had been shown previously that the official statistics on corn from the Rice and Corn Surveys were seriously biased upwards. Part of the bias was due to the adjustment of the design estimates through a pseudo-chain-type of ratio estimator, which also introduced an element of subjectivity in the official statistics. With the findings of the present study, it now appears that the Philippines' data base on crops consists of subjective estimates with questionable accuracy. The only probable exception is rice, whose statistics need a similar detailed investigation. It is also known that the official statistics on livestock, poultry and fisheries are mostly, if not totally, subjectively produced. The quality of these statistics and the procedures used to generate them should likewise be studied and documented in order to provide users with a more complete appraisal of the country's agricultural data base.

From the fifties through to most of the sixties, the agricultural data base was generated from what were called the Crop and Livestock Surveys (CLSs). The CLSs were remarkable in their use of sampling strategies current at the time, including proportional-to-size sampling and independent or replicated subsampling. (For details of the CLS design, see David 1966.) Thus, when BAECON reverted to nonprobability sampling and ad hoc estimation procedures, it was not only ignoring statistical developments of the last two decades; it was in fact stepping back to pre-World War II times. It will be instructive to find out the events, circumstances and reasoning that led to this unfortunate decision.

Given the apparent internal and comparative inconsistencies and large errors in the coconut data discussed in this study, it remains a mystery (at least to the authors) how these have escaped the attention of users, for no one has been roused enough to put his protestations in print. A more disturbing question is why the statistical system has allowed these things to pass through its coordinating, monitoring and other control mechanisms. Are there weaknesses in these mechanisms in particular, and in the system in general, that need to be strengthened?

A complete changeover of BAS operations to statistically sound and efficient survey sampling strategies is required if we should ever entertain hopes of improving the quality and credibility of the country's agricultural data base. (A more detailed appraisal of the current methodologies used in BAS surveys and suggestions for improvement is found in Midzuno 1989.) The task is daunting, for it will demand not only statistical expertise of the caliber currently in very short supply, but also the political will and support of all the agencies concerned.

Appendix 1

Coconut Area by Province, 1978–1986 ('000 ha).

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Abra	...	0.063	0.065	0.065	0.067	0.068	0.070	0.068	0.068
	Benguet	0.005	0.005	0.006	0.006	0.006	0.008	0.010	0.009	0.010
	Ilocos Norte	0.710	0.734	0.734	0.750	0.675	0.689	1.678	2.250	2.606
	Ilocos Sur	1.148	1.400	1.400	1.420	1.410	1.420	1.420	1.500	1.480
	La Union	1.132	0.400	1.135	1.135	1.135	1.140	1.140	1.145	1.150
	Mt. Province	0.057	0.046	0.046	0.054	0.054	0.054	0.054	0.060	0.060
	Pangasinan	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
I		13.052	12.648	13.386	13.430	13.347	13.379	14.372	15.032	15.374
	Batanes	...	...	...	...	...	...	...	...	...
	Cagayan	4.000	4.000	5.000	5.200	5.050	5.050	5.050	5.050	5.050
	Ifugao	...	...	...	...	...	...	...	...	0.012
	Isabela	0.972	0.970	0.973	0.975	0.978	0.978	0.978	0.978	0.978
	Kalinga-Apayao	0.150	0.150	0.240	0.240	0.240	0.240	0.240	0.240	0.240
	Nueva Vizcaya	0.400	0.400	0.340	0.250	0.250	0.250	0.368	0.368	0.368
	Quirino	0.002	0.002	0.002	0.002	0.005	0.050	0.055	0.055	0.100
II		5.524	5.522	6.555	6.667	6.523	6.568	6.691	6.691	6.748
	Bataan	...	...	...	...	...	...	...	...	0.075
	Bulacan	0.250	0.252	0.254	0.254	0.405	0.474	0.501	0.509	0.714
	Nueva Ecija	0.085	0.085	0.085	0.085	0.085	0.086	0.095	0.095	0.110
	Pampanga	0.021	0.022	0.022	0.022	0.022	0.022	0.022	0.045	0.045
	Tarlac	0.280	0.280	0.278	0.280	0.280	0.260	0.260	0.200	0.200
	Zambales	0.980	0.980	1.200	1.250	1.250	1.270	1.300	1.300	1.300
III		1.616	1.619	1.839	1.891	2.042	2.112	2.178	2.149	2.444

Appendix 1. (Cont'd).

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Batangas	38.000	45.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000
	Cavite	9.383	9.383	9.383	9.383	9.383	9.383	18.096	18.096	18.096
	Laguna	53.000	53.000	53.000	53.250	54.050	54.050	73.170	73.165	73.000
	Marinduque	31.484	29.150	36.600	36.600	36.400	36.444	36.450	36.455	36.455
	Mindoro Occidental	5.000	5.020	5.050	5.050	5.050	5.050	5.050	5.050	5.050
	Mindoro Oriental	30.000	30.000	30.000	28.975	28.975	28.975	28.985	28.980	28.975
	Palawan	4.218	6.832	26.843	26.845	26.850	26.975	26.925	26.931	26.950
	Quezon	283.073	283.073	283.073	284.073	282.724	282.124	268.945	268.945	270.150
	Rizal	0.300	0.320	0.320	0.310	0.310	0.310	0.310	0.310	0.310
	Romblon	36.120	26.327	26.071	26.223	26.278	26.286	27.347	27.502	27.615
	Aurora	37.743	37.800	38.050	38.050	38.050	38.050	38.050	30.150	30.150
IV		528.321	525.905	543.390	543.759	543.070	542.647	558.328	550.584	551.751
	Albay	28.100	28.100	26.000	28.500	30.500	40.000	60.034	59.900	59.900
	Camarines Norte	69.000	79.018	79.018	79.018	79.019	79.019	79.019	84.604	84.604
	Camarines Sur	96.600	96.600	96.600	96.600	96.600	96.600	96.600	96.600	96.600
	Catanduanes	4.645	4.645	4.650	4.660	7.950	7.950	7.950	7.965	7.967
	Masbate	98.540	98.800	98.800	98.800	75.000	74.995	75.500	75.500	75.800
	Sorsogon	45.846	45.900	45.905	45.910	45.915	45.915	45.150	45.150	103.687
V		342.731	353.063	350.973	353.488	334.984	344.479	364.253	369.719	428.558
	Aklan	15.000	15.150	15.200	39.071	39.504	34.290	36.007	36.007	31.432
	Antique	9.253	9.253	9.253	9.223	9.223	9.223	9.223	9.225	9.346
	Capiz	12.419	12.700	12.850	12.850	12.850	12.782	12.360	9.900	9.900
	Iloilo	28.159	28.159	28.143	28.145	28.146	19.475	19.475	19.430	19.435
	Negros Occidental	23.725	25.210	28.942	29.000	29.100	29.050	29.050	29.040	36.120
VI		88.556	90.472	94.388	118.289	118.823	104.820	106.115	103.602	106.233
	Bohol	75.000	75.000	70.500	70.500	70.500	70.000	70.000	70.000	70.000
	Cebu	40.000	45.000	46.000	46.000	46.000	44.400	44.410	52.000	52.500
	Negros Oriental	34.300	34.310	34.500	34.500	34.550	34.550	34.550	34.280	34.280
	Siquijor	7.000	7.219	7.220	7.220	7.220	7.046	6.020	6.020	6.055
VII		156.300	161.529	158.220	158.220	158.270	155.996	154.980	162.300	162.835

APPENDIX I (continued)

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Leyte	150.000	150.000	150.000	150.300	150.350	150.300	150.300	150.200	150.205
	Southern Leyte	71.000	71.000	37.062	37.200	30.200	30.200	30.206	30.206	30.215
	Northern Samar	73.750	73.900	73.840	74.000	74.000	74.000	74.000	74.000	74.000
	Eastern Samar	45.500	45.500	45.500	45.500	45.500	45.500	45.500	25.200	25.200
	Western Samar	26.700	28.320	27.118	27.118	38.440	38.440	38.440	37.555	37.555
	Biliran	...	...	...	...	...	...	18.000	18.000	18.000
VIII		366.950	368.720	333.520	334.118	338.490	338.440	356.446	335.161	335.175
	Basilan	45.000	45.500	45.000	45.000	50.770	50.880	50.880	50.880	50.800
	Sulu	25.864	25.500	25.500	25.500	53.398	53.397	53.797	53.797	53.797
	Zamboanga City	46.122	49.000	50.000	55.000	55.000	55.000	55.200	55.200	55.200
	Zamboanga del Norte	96.500	107.000	120.000	120.000	120.000	90.000	150.000	140.000	145.000
	Zamboanga del Sur	170.300	170.500	170.500	170.500	173.000	173.000	173.000	173.005	172.700
IX		383.786	397.500	411.000	416.000	452.168	422.277	482.877	472.882	477.497
	Agusan del Norte	29.614	29.615	29.615	29.615	29.615	29.615	29.615	29.615	29.615
	Agusan del Sur	6.300	8.000	8.000	8.000	8.000	8.050	7.500	8.000	8.500
	Bukidnon	0.450	0.480	0.480	0.480	0.490	0.490	0.490	0.500	0.500
	Camiguin	25.000	25.000	25.000	25.120	26.000	25.965	20.000	20.315	21.506
	Misamis Occidental	95.000	94.136	110.000	110.000	110.000	110.000	110.000	110.000	110.000
	Misamis Oriental	100.000	75.000	75.000	75.000	75.000	75.000	75.000	75.000	75.000
	Surigao del Norte	118.000	120.000	120.000	120.000	120.050	120.000	120.000	120.000	120.000
X		374.364	352.231	368.095	368.215	369.155	369.120	362.605	363.430	365.121
	Davao City	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000
	Davao del Norte	94.694	94.695	94.700	94.700	94.720	94.725	94.725	94.724	94.956
	Davao Oriental	168.000	168.000	167.500	151.105	151.105	160.000	160.000	160.000	158.800
	Davao del Sur	79.200	88.183	88.183	88.183	88.183	88.150	88.150	88.333	88.333
	South Cotabato	111.500	111.500	115.000	115.000	115.000	115.100	115.300	115.300	115.420
	Surigao del Sur	45.000	60.000	61.000	61.500	61.500	61.500	61.650	61.600	61.520
XI		533.394	557.378	561.383	545.488	545.508	554.475	554.825	554.957	554.029

APPENDIX 1 (continued)

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Lanao del Norte	82.450	82.850	86.400	86.710	84.700	84.728	84.736	84.736	84.742
	Lanao del Sur	55.500	55.500	55.000	55.500	65.000	65.000	65.000	65.000	65.000
	Maguindanao	75.114	78.150	79.250	82.125	82.125	82.130	82.135	83.138	91.348
	North Cotabato	16.800	16.720	16.720	16.730	16.730	16.725	16.730	16.500	16.450
	Sultan Kudarat	20.000	25.000	23.000	23.000	60.000	60.000	60.000	60.000	71.410
XII		249.864	258.220	260.370	264.065	308.555	308.583	308.601	309.374	328.950
PHILIPPINES		3044.458	3084.807	3103.119	3123.630	3190.935	3162.896	3272.271	3245.881	3334.715

. . . denotes data not available.

Source: Bureau of Agricultural Statistics

Appendix 2. Coconut Production, 1978–1986 ('000 mt.).

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Abra	0.2	0.4	0.1	0.1	0.1	0.1	0.2	0.3	0.3
	Benguet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ilocos Norte	2.7	2.2	2.3	1.9	7.1	1.3	2.1	2.1	2.6
	Ilocos Sur	4.4	4.2	4.2	4.1	3.7	3.0	3.2	3.3	3.2
	La Union	5.3	3.5	3.9	6.7	9.5	8.1	18.7	18.1	18.2
	Mt. Province	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Pangasinan	66.4	68.3	80.3	88.5	91.3	85.6	89.1	81.3	76.8
I		79.2	78.8	90.9	101.6	111.9	98.4	113.5	105.3	101.4
	Batanes	...	...	...	...	...	...	...	...	...
	Cagayan	24.0	10.0	25.4	37.0	20.6	19.9	18.9	26.4	18.4
	Ifugao	...	...	...	...	...	...	...	...	0.1
	Isabela	12.2	2.5	2.4	2.3	2.5	2.6	1.8	2.2	2.1
	Kalinga-Apayao	0.7	0.7	1.8	1.6	1.2	1.1	1.1	1.1	1.2
	Nueva Vizcaya	1.2	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.4
	Quirino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II		38.0	14.4	30.5	41.8	25.2	24.6	22.9	30.7	23.2
	Bataan	...	...	...	...	...	...	...	...	0.1
	Bulacan	1.0	1.1	1.1	1.3	1.4	2.5	2.7	2.9	4.5
	Nueva Ecija	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1
	Pampanga	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2
	Tarlac	0.5	0.6	0.5	0.5	0.8	0.9	0.4	0.5	0.5
	Zambales	1.7	3.2	5.1	5.5	4.9	6.1	6.0	5.8	5.7
III		3.5	5.1	6.9	7.6	7.4	9.8	9.4	9.5	11.1
	Batangas	270.8	308.9	227.8	216.8	196.8	164.3	203.4	190.5	133.1
	Cavite	50.9	49.3	51.9	53.3	64.2	46.4	18.5	26.2	30.8
	Laguna	192.8	132.6	140.3	138.8	181.1	136.8	116.7	116.7	99.5
	Marinduque	447.4	100.2	131.1	198.4	143.3	38.3	183.2	257.7	294.7
	Mindoro Occidental	21.4	25.4	40.7	28.5	28.5	26.7	46.8	46.8	46.3
	Mindoro Oriental	73.8	73.9	73.8	73.2	59.3	53.4	62.1	78.5	128.8

APPENDIX 2 (continued)

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Palawan	22.6	28.7	87.2	87.4	82.6	90.0	97.4	100.0	101.4
	Quezon	3483.1	4586.5	4451.6	3176.0	2007.0	976.5	749.8	700.6	879.4
	Rizal	1.3	1.3	1.3	1.2	1.1	1.0	1.1	1.1	1.1
	Romblon	79.2	40.0	65.7	91.5	95.9	92.1	99.5	101.5	105.0
	Aurora	94.4	49.6	83.2	61.7	58.5	78.2	93.4	112.1	129.1
IV		4737.6	5396.3	5354.5	4126.8	2918.3	1703.7	1671.9	1731.8	1949.1
	Albay	243.5	153.1	140.5	95.6	109.3	92.6	144.0	184.8	174.9
	Camarines Norte	74.1	74.1	55.0	72.8	29.3	98.9	137.3	174.2	201.4
	Camarines Sur	171.0	177.6	195.4	376.2	63.3	48.4	55.0	83.9	129.1
	Catanduanes	7.0	9.1	17.0	17.9	5.2	4.6	4.3	4.6	3.7
	Masbate	167.5	224.9	345.8	293.9	228.4	129.4	109.1	193.8	185.0
	Sorsogon	298.7	182.1	224.8	164.6	71.7	34.6	60.9	53.5	142.4
V		961.8	821.1	978.5	1021.0	507.0	408.4	510.6	694.8	836.5
	Aklan	68.2	68.3	82.9	103.6	165.8	169.0	85.0	41.7	45.6
	Antique	47.9	47.9	45.3	45.5	68.4	59.7	90.4	109.1	97.6
	Capiz	38.8	39.4	44.3	45.7	46.4	20.6	17.5	7.4	10.7
	Iloilo	87.6	93.5	93.5	93.5	93.5	53.2	60.1	87.4	90.5
	Negros Occidental	190.7	222.2	198.0	199.1	148.3	129.2	114.0	141.3	144.6
VI		433.1	471.2	464.0	487.4	522.5	431.7	367.0	387.0	389.1
	Bohol	655.2	585.0	378.0	374.0	345.0	325.3	246.2	300.0	356.4
	Cebu	192.4	202.8	208.0	207.3	175.7	125.1	121.6	129.5	134.0
	Negros Oriental	196.6	194.5	194.6	195.2	193.5	164.3	156.6	97.0	106.3
	Siquijor	32.4	32.4	32.6	32.4	30.6	29.6	23.4	25.1	23.9
VII		1076.6	1014.7	813.2	809.0	744.8	644.2	547.8	551.5	620.6
	Leyte	629.3	624.0	642.5	642.8	570.0	525.9	498.3	503.9	502.7
	Southern Leyte	182.4	182.4	104.3	107.3	28.8	27.6	22.2	26.1	35.1
	Northern Samar	236.6	208.1	237.6	184.4	111.3	100.1	110.5	110.4	97.6
	Eastern Samar	97.8	87.4	95.9	137.3	155.7	151.8	145.6	80.5	87.0
	Western Samar	187.2	116.2	119.6	152.5	147.1	85.2	72.8	75.6	108.3
	Biliran	...	...	...	...	...	...	50.2	33.0	40.5
VIII		1333.3	1218.1	1199.9	1224.4	1013.0	890.7	899.7	829.7	871.2

Appendix 2. (Cont'd).

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Basilan	149.6	271.6	272.8	273.6	308.8	191.2	180.1	197.3	186.3
	Sulu	376.7	81.5	82.2	89.4	144.1	156.8	188.8	200.3	200.3
	Zamboanga City	219.2	214.1	217.2	220.0	271.0	240.7	250.3	250.1	247.5
	Zamboanga del Norte	465.9	468.7	339.2	284.0	277.1	135.0	151.5	162.0	126.4
	Zamboanga del Sur	498.6	508.8	517.9	551.8	871.4	585.9	340.6	454.5	537.2
IX		1710.1	1544.8	1429.3	1418.9	1872.3	1309.6	1111.3	1264.1	1297.6
	Agusan del Norte	190.8	190.8	91.3	71.3	77.7	66.8	70.3	62.6	74.5
	Agusan del Sur	3.5	3.5	3.3	2.9	2.6	2.3	3.6	4.5	4.8
	Bukidnon	3.1	4.3	3.9	3.9	3.8	1.6	2.9	3.4	4.0
	Camiguin	72.0	63.8	63.8	71.9	77.6	43.7	28.6	48.5	35.4
	Misamis Occidental	149.5	152.1	151.4	200.0	208.1	167.2	119.0	171.6	251.1
	Misamis Oriental	375.0	451.0	375.0	345.0	360.0	100.0	173.0	292.0	236.0
	Surigao del Norte	535.5	542.1	560.8	565.0	541.8	353.4	262.6	124.7	166.0
X		1329.4	1407.5	1249.4	1259.9	1271.6	735.1	659.9	707.3	771.8
	Davao City	75.0	75.0	99.1	91.8	90.9	57.1	92.2	61.2	63.6
	Davao del Norte	261.8	303.6	295.5	669.5	1005.1	1002.5	998.7	930.8	943.0
	Davao Oriental	1255.7	1520.6	1613.6	1629.7	1673.4	1530.4	1541.1	1554.6	1562.3
	Davao del Sur	725.0	508.0	508.4	508.7	563.2	390.2	435.6	449.0	448.2
	South Cotabato	298.9	298.9	332.7	246.2	382.5	321.5	663.3	589.0	799.9
	Surigao del Sur	138.4	125.9	109.5	94.2	80.9	147.3	147.4	135.7	101.5
XI		2754.8	2832.0	2958.6	3240.0	3796.0	3448.9	3878.3	3720.3	3918.6
	Lanao del Norte	301.1	324.0	366.7	372.0	390.3	381.7	384.0	371.3	386.6
	Lanao del Sur	211.4	211.4	211.4	264.2	250.0	226.2	220.7	186.3	147.1
	Maguindanao	312.4	313.6	337.0	354.0	404.9	414.7	407.0	392.3	415.5
	North Cotabato	429.7	50.0	46.6	45.1	53.1	46.7	26.6	30.4	30.3
	Sultan Kudarat	30.0	35.0	55.0	86.0	117.1	119.9	142.5	141.6	156.0
XII		1284.6	934.0	1016.8	1121.3	1215.4	1189.2	1180.9	1121.9	1135.5
PHILIPPINES		15742.1	15737.9	15592.6	14859.7	14005.4	10894.2	10973.2	11153.7	11925.8

. . . denotes data not available.

Source: Bureau of Agricultural Statistics

Appendix 3. Number of Bearing Trees, 1978-1986 ('000).

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Abra	31	35	10	10	10	10	10	11	12
	Benguet	0	1	0	0	1	0	0	1	1
	Ilocos Norte	80	80	93	94	93	80	85	85	131
	Ilocos Sur	89	83	83	82	81	81	80	80	80
	La Union	174	174	175	175	175	174	181	182	182
	Mt. Province	8	6	6	8	10	8	8	8	8
	Pangasinan	1,405	1,440	1,458	1,566	1,566	1,583	1,584	1,584	1,496
I		1,787	1,819	1,825	1,934	1,937	1,935	1,948	1,950	1,910
	Batanes	...	...	...	...	...	...	...	...	...
	Cagayan	500	495	525	680	555	480	525	572	563
	Ifugao	...	...	...	...	...	...	...	...	2
	Isabela	93	94	94	95	120	120	120	120	120
	Kalinga-Apayao	23	25	27	50	50	55	55	23	23
	Nueva Vizcaya	20	20	15	17	15	17	24	24	24
	Quirino	0	0	0	0	0	1	1	2	2
II		636	634	662	841	740	672	724	740	733
	Bataan	...	...	...	...	...	...	...	...	13
	Bulacan	23	23	23	26	37	43	46	49	65
	Nueva Ecija	3	4	5	5	5	5	7	7	7
	Pampanga	3	3	3	3	4	4	4	6	6
	Tarlac	27	27	23	23	27	36	23	23	20
	Zambales	138	134	144	158	152	160	126	122	123
III		194	192	198	216	225	247	206	207	234
	Batangas	4,867	5,928	3,432	3,432	3,432	3,432	3,510	3,508	3,509
	Cavite	1,271	1,275	1,275	1,275	1,287	1,287	1,093	1,093	1,087
	Laguna	9,266	9,072	9,078	8,505	8,148	8,144	11,469	11,468	11,104
	Marinduque	3,426	3,668	4,410	4,410	4,393	4,393	4,677	4,690	4,690
	Mindoro Occidental	400	260	300	300	300	300	300	300	300
	Mindoro Oriental	3,151	3,151	3,149	3,148	3,136	3,126	3,365	3,519	3,526
	Palawan	248	368	1,027	1,023	1,031	1,218	1,225	1,250	1,284

APPENDIX 3 (continued)

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Quezon	47,123	56,495	53,670	53,662	52,193	51,149	50,322	51,099	51,137
	Rizal	40	41	41	42	41	40	42	42	43
	Romblon	2,354	2,362	2,314	2,330	2,318	2,368	2,389	2,420	2,438
	Aurora	3,255	3,230	3,249	3,250	3,250	3,266	3,397	3,397	3,397
IV		75,401	85,850	81,945	81,377	79,529	78,723	81,789	82,786	82,515
	Albay	2,354	2,475	2,486	2,492	3,080	3,850	5,506	5,498	5,498
	Camarines Norte	4,810	4,790	2,781	4,627	2,400	3,660	4,590	5,801	5,802
	Camarines Sur	7,700	7,700	8,250	8,800	8,250	6,050	7,700	6,150	6,160
	Catanduanes	394	419	424	425	355	430	380	385	448
	Masbate	8,667	8,670	8,670	8,670	6,030	6,029	6,815	6,925	6,925
	Sorsogon	5,496	5,496	5,496	5,497	3,660	3,660	4,260	4,260	4,742
V		29,421	29,550	28,107	30,511	23,775	23,679	29,251	29,019	29,575
	Aklan	2,130	2,134	2,138	4,298	4,336	4,260	2,881	2,981	3,122
	Antique	1,300	1,300	1,300	1,306	1,306	1,346	1,300	1,399	1,409
	Capiz	1,050	1,123	1,210	1,265	1,265	1,012	527	338	363
	Iloilo	3,815	3,816	3,816	3,817	3,818	2,729	2,696	2,760	2,760
	Negros Occidental	3,488	3,019	3,450	3,713	3,720	3,713	3,618	3,825	3,675
VI		11,783	11,392	11,914	14,399	14,445	13,060	11,022	11,303	11,329
	Bohol	21,000	21,000	9,750	9,750	9,000	9,300	9,300	9,300	9,750
	Cebu	4,940	5,200	5,460	5,421	5,421	5,421	5,421	5,460	5,460
	Negros Oriental	5,720	5,721	5,728	5,728	5,720	5,516	5,528	3,293	3,271
	Siquijor	1,153	1,153	1,152	1,153	1,152	1,021	928	944	946
VII		32,813	33,074	22,090	22,052	21,293	21,258	21,177	18,997	19,427
	Leyte	15,750	16,200	16,500	16,514	18,000	18,000	17,850	17,787	16,808
	Southern Leyte	9,120	9,120	5,550	5,552	3,781	5,781	3,782	3,840	3,915
	Northern Samar	7,801	7,808	7,305	7,309	7,419	6,677	7,800	7,280	7,280
	Eastern Samar	7,980	7,600	7,900	8,100	7,975	7,600	7,800	4,368	4,360
	Western Samar	3,637	2,783	2,783	3,735	3,871	3,871	3,871	3,781	3,781
	Biliran	...	...	...	...	2,128	2,128	2,073	2,073	2,016
VIII		44,288	43,511	40,038	41,210	43,174	44,057	43,176	39,129	38,160

Appendix 3. (Cont'd).

Region	Province	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Basilan	4,560	4,600	4,600	4,560	4,800	5,194	4,766	4,813	4,800
	Sulu	2,397	2,397	2,500	2,520	7,862	5,961	7,493	7,494	7,494
	Zamboanga City	4,512	4,738	4,740	5,000	5,000	5,000	5,010	5,000	5,000
	Zamboanga del Norte	10,438	10,500	10,550	11,250	11,250	7,000	10,000	10,000	9,500
	Zamboanga del Sur	9,604	9,650	9,650	9,650	17,256	17,256	16,800	17,000	15,800
IX		31,511	31,885	32,040	32,980	46,168	40,411	44,069	44,307	42,594
	Agusan del Norte	3,407	3,407	3,407	3,407	3,939	3,673	3,540	3,540	3,934
	Agusan del Sur	192	211	211	211	211	211	300	300	336
	Bukidnon	42	48	49	48	48	48	48	48	48
	Camiguin	2,550	2,550	2,550	2,625	2,700	3,161	2,534	2,329	2,535
	Misamis Occidental	7,280	8,250	8,250	8,800	8,800	8,800	12,100	9,870	10,230
	Misamis Oriental	7,500	9,000	9,000	9,000	9,000	7,500	9,000	9,150	9,150
	Surigao del Norte	12,600	12,661	12,660	12,660	12,661	12,661	12,661	7,424	9,240
X		33,571	36,127	36,127	36,751	37,359	36,054	40,183	32,661	35,473
	Davao City	2,500	2,500	2,500	2,550	2,550	2,502	2,550	2,550	2,700
	Davao del Norte	8,183	10,780	10,795	10,701	10,700	10,700	10,700	10,700	10,700
	Davao Oriental	14,500	14,520	14,464	14,855	14,900	15,000	15,065	15,060	18,066
	Davao del Sur	8,996	8,472	8,473	8,484	8,593	8,712	8,712	8,904	9,024
	South Cotabato	7,500	7,500	7,500	7,171	7,120	7,171	7,567	9,858	9,859
	Surigao del Sur	4,000	4,500	4,800	4,910	4,910	4,910	4,920	4,905	3,894
XI		45,679	48,272	48,532	48,671	48,773	48,995	49,514	51,977	54,243
	Lanao del Norte	7,823	7,396	8,673	8,867	8,728	8,801	8,765	8,811	8,833
	Lanao del Sur	5,512	5,512	5,512	5,512	5,250	5,250	5,320	5,320	5,333
	Maguindanao	6,445	6,728	6,735	6,860	6,875	6,875	7,109	7,255	7,182
	North Cotabato	1,574	1,578	1,575	1,578	1,902	1,902	1,902	1,824	1,822
	Sultan Kudarat	1,500	1,000	2,000	2,000	2,550	2,500	3,000	2,950	3,050
XII		22,854	22,214	24,495	24,817	25,305	25,328	26,096	26,160	26,220
PHILIPPINES		329,938	344,520	327,973	335,760	342,723	334,420	349,156	339,235	342,413

. . . denotes data not available.

Source: Bureau of Agricultural Statistics

REFERENCES

Asian and Pacific Coconut Community. *Coconut Statistical Yearbook,* Table 1.1, 1986.

David, I.P. "Development of a Statistical Model for Agricultural Surveys in the Philippines." Master's thesis, University of the Philippines in Los Baños, 1966.

David, I.P., A.N.C. Mendoza and D.C. Besa. Evaluation of Philippine Corn Statistics. *Journal of Philippine Development* Vol. XVII, No. 1 (First Semester 1990) : 33-36.

Mangabat, M.C. and E.V. Tepora. "Coconut, Tobacco and Abaca Statistics from Various Agencies: Consistency and Validation Procedures." Paper presented at the Joint Conference on Statistics, 8-10 January 1990, Manila.

Midzuno, Hiroshi. *Consultancy Report for Technical Assistance Project 949: Improvement of Philippine Agricultural Statistics.* ADB, Manila, 1989.